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West Europe Report

SCIENCE AND TECHNOLOGY

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WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

ADVANCED MATERIALS

BRIEFS

MAINZ POLYMER RESEARCH INSTITUTE--A new Institute for Polymer Research at the Max-Planck Society has been in existence since the beginning of the year in Mainz. As a neutral research site, it is to prepare the bases for new generations of synthetics, from industry in particular will profit. Of particular importance is the drawing up of new mechanical properties, such as matrix materials or those with a "built-in" reinforcing effect. In addition, synthetics with light-conducting properties or with usable electrical and magnetic properties. New synthetics of this type can be achieved, if more data about cystalline structures and how to control them can be gathered. In the view of polymer scientists, it is no longer enough to investigate only chemical properties and reactions to realize these goals. Only close cooperation between physicists and chemists can help. The new Institute is headed by three renowned scientists: Prof Erhard Fischer, Prof Gerhard Wagner and Prof Hans W. Spiess. New construction of a separate research institute in Mainz will start this year. When it is complete, about 100 jobs will be available for permanent staff members. An additional 50 jobs are to be allocated to visitors. The new building will cost about DM 46 million. [Text] [Bern TECHNISCHE RUNDSCHAU in German 7 May 85 p 7] 9581

CSO: 3698/42

AUTOMOBILE INDUSTRY

BESSE TAKES STEPS TO IMPROVE FINANCES AT FRANCE'S RENAULT

Duesseldorf VDI NACHRICHTEN in German 28 Jun 85 p 6

[Article by G. Kacher: "New Brooms Sweep Clean"]

> [Text] New brooms sweep clean. The "new broom" at Renault is Georges Besse and he has been in office since 24 January 1985. Mr Besse has only one assignment: improving the financial health of the state-owned company, which is deep in debt. The 57-year old manager, who most recently saved the Pechiney steel company from closing down by using gentle force, attracted attention in the spring as the result of some immediate measures.

Besse halted a sweeping treat of cooperation with the USSR as well as the planned construction of a ceramics factory, the development of the successor to the Renault 5 Rodeo and plans to export the R 25 and Espace models to the United States. This was just the overture to an entire symphony of decisions concerning company policy which are intended to lead Renault out of the red.

The decline of Regie Renault took place with almost fear-inspiring rapidity. In 1983 the cars from Billancourt near Paris had left their European competition behind, but 18 months later Renault had fallen to sixth place in the new vehicle registration statistics, behind Ford, Fiat, GM, VW and the PSA group.

This plunge was not without its effects on the company's balance sheet. While the deficit in 1983 could be kept within reasonable bounds at Fr 1.57 billion, Renault recorded a record loss in 1984 of Fr 12.5 billion (more than DM 3 billion). Since long-term obligations have accumulated in the course of the year to about Fr 30 billion (DM 10 billion), Renault is almost bankrupt from an operating point of view.

Where did this crisis originate? The commercial vehicle subsidiary RVI, which in 1984 alone lost Fr 2.4 billion, has been registering the highest relative losses for years. Close observers of the scene claim that Renault would dearly love to withdraw from the truck business, but a buyer for RVI would very likely be just as hard to find as one for the agricultural machinery branch. The company's holdings in the United States are causing growing headaches for

management. While its involvement with the US commercial vehicle manufacturer Mack could certainly pay off over an extended period, Renault's 46-percent investment in the fourth-largest automobile company, American Motors, has so far brought only a loss of $650 million. Sales of the Alliance and Encore models (R 9 and R 11), which are built under license in the United States, are steadily declining, AMC head Paul Tippet resigned surprisingly following a $29 million deficit in the first quarter of 1985, and after arguments with the union management is now threatening to close three assemlbly plants. Rumours about the sale of the still profitable Jeep division have been vehemently denied.

Renault's employment policy has been ill-starred since 1979 at the latest, not least because of the strong influence of the Communist trade union CGT. While GM, for example, has reduced wage costs in the last 6 years by one-quarter and major rival PSA (Peugeot, Citroen, Talbot) managed with a moderate wage increase of 10 percent, today Renault is paying out one-third more for wages than in 1979. The situation in the area of manpower is equally dismal. In contrast to PSA or Fiat, who have reduced the number of workers by almost one-third since 1979, Renault has managed to reduce manpower in the same period by just 7 percent.

The automobile manufacturer, which was nationalized exactly 40 years ago, is falling farther and farther behind in production as well. The high-volume R 9 and R 11 models, which are ranged in the same class as the Golf, as well as the outdated R 18, are experiencing increasingly poor sales, and the new R 5 has also not lived up to expectations. In addition to product-specific mistakes (plain styling, antiquated engines, poorly balanced chassis, too many electronic gimmicks), marketing errors are also responsible for the decline in European new vehicle registration figures. The new R 5 ("Your Little Friend") was available at its introduction in only a few colors and in versions with expensive equipment, and exclusively as a two-door model with a gasoline engine. Peugeot's successful 205, however, was available from the start in four different models, with four doors and and optional diesel engine.

Renault is currently trying to win back lost ground with the R5 Turbo GT and the R5 four-door, but at least in the very important French domestic market success is still eluding them. While the old R5 captured a market share of 16 percent in its best year (1980), its successor is currently achieving barely 8 percent. The sales target for 1985 has already been corrected downward twice. The small-car success of recent years, the Peugeot 205, has secured a 15-percent share of new car business in the meantime. An inventory survey shows that Renault's passenger car production is working at only about 70 percent of capacity and that the market share in France has fallen in the last 3 years from 39 percent to 30.5 percent. For the time being, only the Renault R25, the Espace and the Alpine GTA are selling well.

In view of these figures, even optimists are making careful judgments about the company prospects for the future. The product itself is certainly a primary problem. While Renault had genuine trendsetters in its program in the past with vehicles like the R4, the R5 and the R16, there are only yawns at the sight of the 1985 model range. The specialty vehicles mentioned above,

the R25, the Espace and the GTA, enrich the automobile landscape without any doubt, but the volume-production cars, the R9, the R11, the R18 and even the new R5 seem colorless and they show no sign of the French flair that is so highly regarded here. One may well be curious about what ideas the Renault engineers will come up with for the future. The first result of their efforts, the successor to the R18, is to be unveiled in March 1986 (6 months after the Peugeot C28); we will have to wait at least 3 years for the new R9/11.

The reduction in personnel planned for the next few years will probably be even more costly than the development of new models. In conjunction with the modernization of production facilities, it will initiate a process of shrinking to a healthy size which will not be completed until the end of this decade. Following a reduction in the workforce of 10,500 mean since 1984 (the welfare costs of this measure alone came to about DM 2 billion), Georges Besse is expected to reduce the number on the payroll by up to 25,000 workers by the end of 1986. This year alone about 10,000 are to be given early retirement. The cutbacks in personnel affect not only the production area, but also the administration, where early retirement and an absolute hiring freeze were likewise ordered. Although Renault can again count on financial assistance from the state in 1985 in the amount of Fr 5 billion, the reduction in personnel will very probably be a continuing burden on the company's negative balance, which, converted, is currently running at about DM 1,600 for each vehicle sold. Georges Besse is really not to be envied his assignment. But if he does succeed in making the apparently impossible possible, the French will celebrate him as they once did Napoleon.

9581
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COMPUTERS

ECRC PRODUCTS COULD BE AVAILABLE IN THREE YEARS

Paris ELECTRONIQUE ACTUALITES in French 4 Oct 85 pp 1,5

[Article by Ph. Marel: "Joint Bull-ICL-Siemens Research Center: The ECRC Should Deliver its First Artificial-Intelligence Products in 3 Years"]

> [Text] Munich--To describe the research center he is heading, Herve Gallaire (formerly in charge of artificial-intelligence research at CGE [General Electric-tric Company]) does not hesitate to call it an "industrial center of a new type." Indeed, the three leading European manufacturers are committed to the ECRC (European Computer Research-Industry Center) in equal proportions and on a pre-competitive basis; within three years, the center should enable them to offer software packages based on artificial-intelligence concepts. The size of the center's operating budget, DM 20 million per year, reflects the size of the stakes.

Located on the second floor of a business building in a Munich suburb, the ECRC would seem to be just another administrative office if it were not for the rather strict automated-access control and the many data-processing terminals available to researchers.

Yet, when the ECRC is fully operational, by the end of 1986, it will employ some 50 researchers, i.e. about 10 percent of the world's artificial-intelligence specialists, and its operating budget will be DM 20 million (approximately FF 60 million) per year, a very large amount considering the domain involved.

Like the ESPRIT program [European Strategic Program for R&D in Information Technology], the ECRC, whose creation dates back to 1983 and which has been in operation since the beginning of 1984, was set up on a pre-competitive basis and all partners are committed to it in perfectly equal proportions.

This type of organization, therefore, implies identical financial commitments on the part of Bull, ICL [International Computers Ltd.] and Siemens, both for the capital stock (DM 1.8 million) and for research financing.

But, too, the center has a scientific committee for each of the three companies, to ensure a priori that their needs are adequately met, whereas most researchers are delegated by their own research centers, in principle for a three years' period.

Although there is no plan to allow partners other than the three European supercomputer manufacturers to acquire capital stock, the center nevertheless remains open to outside contacts.

At present, 20 percent of the 36 researchers working there come from universities and public research centers, bringing to 9 the number of countries represented.

In addition, the ECRC does not exclude participating in programs such as the ESPRIT program, should the occasion arise.

Although there are now many artificial intelligence research centers--private laboratories (Xerox, IBM, Hewlett-Packard, MCC [expansion unknown], etc.), public laboratories (INRIA [National Institute of Data-Processing and Automation Research] or ICOT [Institute for New-Generation Computer Technology] in Japan) or universities (Stanford, MIT, Berlin, etc.)--very few have that many resources, especially material resources, whereas the ECRC's strict specialization in the field of knowledge-base development makes it, according to Herve Gallaire, "one of the most advanced centers in one of the two major domains of artificial intelligence."

The systems on which its researchers are working come not only from the three manufacturers (Perq from ICL, SPS 7 and 9 from Bull, minicomputers from Siemens), but from other manufacturers as well (Digital and Symbolics in particular).

All the development work is done under Unix 4.2, communications are using Ethernet, and a progressive evolution toward the OSI [open-systems interconnection] model is also contemplated.

There are four research teams, each of which is in charge of a programming module, and these modules are linked to one another to form a complete knowledge-processing chain.

The first team is devoting itself to programming languages which, in this case, must cover the required inference capabilities.

The second group is working on knowledge-based systems, i.e. the relations between the database management system (DBMS) and inference techniques. At this stage, the work completed on database management systems involves the manipulation of the knowledge that it stores and no longer the data themselves.

The third research stage covers man-machine interaction for decision-making systems in which, as Herve Gallaire pointed out, it is "essential that the layman should be able to access and use the system."

A prototype of this program was shown to us during our visit; it involved a financial decision-making process during the analysis of a general operating statement.

The system presents spreadsheets covering several years and accompanied by a number of very precise comments with perfect syntax. If the user decides to alter one of the spreadsheet data, not only is the spreadsheet updated instantly, but all comments are also altered in a syntax quite as perfect as the first time.

The fourth group is working on symbolic data-processing architectures, as the development of a user-oriented system to aid in decision-making involves manipulating not only numbers and digital data, but also the symbols and symbolic data that are at the heart of decision-making mechanisms.

Expert-System Tools

As we can see, all of the ECRC's work is very much linked to the expertise of the three partners, and the tools developed will be grafted onto existing products.

However, and this is another original feature of the center, no definite deadlines have been set, so that the center's researchers will have all the time they need to refine their developments.

This does not exclude that a number of products could become available in the manufacturers' catalogs within a little over three years.

All the same, the development of expert systems, another major artificial-intelligence field and the battle-horse of the Japanese under the so-called "fifth-generation" project, is not included in the center's development program.

To this, Herve Gallaire answers that you cannot do everything and that, anyhow, a number of products that will result from research done at the center will be tools designed to develop expert systems.

Will this second stage be tackled individually by each of the three companies, or will it be the subject of further cooperation?

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COMPUTERS

BULL CONTINUES REORGANIZATION BEGUN IN 1983

Paris ELECTRONIQUE ACTUALITES in French 11 Oct 85 p 12

[Article: "New Organization at Bull"]

> [Text] The Bull group just reorganized its internal structures. The company indicated that these were a number of additional measures complementing the full reorganization started at the end of 1983.

Bull's objectives consist in "continuing its commercial adaptation to market trends and objectives, accelerating its international development, simplifying and strengthening the operating structures of Bull Sems and Bull Transac."

The latter point was mentioned by Mr Lorentz at his press conference last month, when the provisional operating results of the group were made public.

Actually, what they want to do is to simplify internal billing procedures, while heading toward legal integration of these two subsidiaries to Bull Systems, for tax reasons.

As far as operations are concerned, the marketing network will consist of five entities headed by Mr Didier Ruffat, manager of marketing networks.

These are the French marketing network headed by Mr Coulon; the French consumer marketing network headed by Mr De Tocqueville; the German network entrusted to Mr Screr; the European marketing network headed by Mr Levy-Soussan; and finally the overseas marketing network headed by Mr Sidobre.

In addition, an "industrial solution unit" was created and entrusted to Mr Perpigna, to devise and implement specific solutions. Bull Peripherals has now been given a marketing department, headed by Mr Mario Grossi. The functional departments of the group have now been reinforced with Mr Napolitano, in charge of Bull's international relations development and Mr Michel Bloch, new manager of strategy and marketing. At Bull Sems, Mr Camozzi is now in charge of the server product line, and Mr Thorn is in charge of the SPS 7 and 9 products, while at Bull Transac Mr Piffaut has been placed in charge of the terminals and work stations line.

These structural changes are accompanied by outside recruiting.

Mr Ader, formerly manager of the Arthur D. Little Paris office, is now in charge of the organization department of the procedures division; Mr Picard, formerly general manager of Enertec (a Schlumberger subsidiary), becomes assistant to the general manager of Bull Systems and, finally, Mr Michel Prudhomme, formerly marketing manager of Burroughs France, becomes assistant to the manager of the French marketing network.

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FACTORY AUTOMATION

HIGHLIGHTS OF SIXTH EMO MACHINE-TOOL SHOW

Paris ELECTRONIQUE ACTUALITES in French 4 Oct 85 pp 1,4

[Article by H. Pradenc: "Close to 300,000 Visitors at the 1985 EMO Show in Hanover: Slow Recovery of the European Machine-Tool Industry in 1985"]

> [Text] Hanover--As was to be expected, the 6th EMO [Machine-Tool Show] which was held in Hanover until 25 September, drew close to 300,000 visitors from the whole world. This event somehow punctuates the period of acute crisis experienced by the machine-tool industry, and it was a very much updated catalog of machines and control systems that was presented.
>
> Manufacturers, especially European manufacturers, are pleased but this does not mean that the game has been won; more time is still required to make sure that the recovery continues. Also, European professionals still face a difficulty, viz, the lack of Community and state-level projects to help the industry.

Some 300,000 visitors went to the 6th EMO in Hanover, where 90 percent of the world machine-tool production was on show. European equipment covered close to 90 percent of all the booth area. As is known, the 12 CECIMO (European Machine-Tool Coordination Committee) member countries represent, by value, over 32 percent of the world machine-tool production.

European Recovery in 1985

Like their colleagues, French manufacturers represented at the Hanover 1985 show expressed their satisfaction. This event enabled them to have contacts with foreign visitors and also, oddly enough, with potential French clients who made up the largest contingent of foreign visitors in Hanover. Presented by its organizers as an export platform, the 6th EMO was of special interest to our manufacturers whose domestic sales declined by 10 percent from 1982 to 1983, while their export sales increased by 11 percent. In 1984, world-wide machine-tool sales amounted to over $20 billion, representing a growth rate of 5.8 percent in dollars, due mainly to the United States and Japan.

European recovery is taking place in 1985. According to forecasts, Germany and Italy will return this year to their 1981 positions. Great-Britain will not reach the 1981 level, and France, at 60 in 1985, will remain below the 1981 reference mark of 100. Since the French market is still weak, manufacturers must intensify their export operations. In this respect, the first quarter of 1985 showed good results, with a 30-percent growth in exports over the same period in 1984.

While favorable signs are becoming apparent as far as business is concerned, the CECIMO on the other hand urged the European Community and the governments of member countries to give some new impetus to the European machine-tool industry. To face the U.S. and Japanese competition, manufacturers would like to see the creation of "authentically" European projects. CECIMO asked that no domain be overlooked, from research and development to taxation and financing.

In France, in particular, the industry feels that the research credits promised in the Machine-Tool Plan have not been forthcoming. At present, there are two domestic projects in France: very high speed machining, and research on new machines. That is the independent machining center that could be used as a stand-alone machine-tool or integrated into a system. Research is carried out by Intelautomatisme, Num (numerical control) and SAGEM [Company for General Applications of Electricity and Mechanics] (system aspect). The second project involves the development of a multi-purpose laser machine-tool. Cilas [Industrial Laser Company]-Alcatel and Limoges-Precision are carrying out this work.

Current Developments at Renault Automation

For Renault, the Sixth EMO provided an opportunity to sum up the development carried out by the Renault-Automation CIM [computer-integrated manufacturing] pole. It thus presented the M3F modular multifunction flexible machine; a CAD/CAM site integrating operations ranging from the reading of points on a three-dimensional measuring machine to the final control of the machined part; a low-end three-dimensional measuring machine; a new measuring robot; and a 5-axis laser robot. Renault-Automation is continuing its research on three-dimensional vision applied to bin-picking robots. The results of this work will be presented in June 1986 at the Paris CIM Show. Research is also carried out on seam-welding control using the Soro telemetry system. CAD robot programming, a must for small and intermediate series production workshops, is also included in the program of Renault-Automation which devotes close to 10 percent of its revenues (sales of FF 1,855.5 in 1984) to research whereas the average for the industry is 6 percent.

Cilas-Alcatel is developing power lasers for cutting, welding and heat treatment, which are sold either to machine manufacturers or directly for applications. This company, which took over Soro and BBT [Barbier, Benard and Turenne Company], two optoelectronics specialists, accounts alone for FF 250 million in sales, including FF 20 million for industrial lasers. Its goals are to reach FF 60 million for this activity in 1988, due to the expansion that the market is about to experience, a market on which its main competitors are the U.S. Photon and Coherent and, to a lesser extent, the German

Rofin-Sinar. The only company showing a welding laser in Hanover, Cilas-Alcatel, is planning to set up an international distribution network. The company is now offering laser sources of 1 to 4 kW and they have announced a 7 to 8 kW product referenced CI 8000 for 1986-1987.

Toward Numerical Controls for Flexible Workshops

At the 1985 EMO, Num introduced its new line of digital controls, the NUM 750 computerized numerical control for milling and drilling machines, machining centers and 1-4 axis machines. The company, which signed an agreement on speed-change drive units with the British GEC [General Electric Company] one year ago, was showing a new line of AC units of this type. This year, Num's sales should reach FF 150 million, including 27 percent of export sales, mainly to Switzerland. Germany, a stronghold of Siemens where the Japanese are also active (Fanuc), accounts for about FF 10 million of Num's sales.

At Siemens, the introduction of the Sinumerik 850 and 880 numerical controls is an answer to the future need for flexible-cell controls. Thus, the 880, to be sold starting early in 1986, will control up to 27 axes in 16 concurrent channels, and the 850 up to 12 axes in 8 concurrent channels. Another novelty from this manufacturer: fully-numerical axis controls providing a link with the numerical control without an analog element inbetween.

Oriented toward systems and machines ready to be built into cells, SAGEM is developing mostly software. The company cooperates with Num which takes care of the hardware part of orders and internal software, and it develops interactive software itself. This systems activity accounts for sales of FF 100 million per year. People here point to the difficulties encountered in exporting such systems, in particular due to linguistic barriers which make it harder to agree on a system definition.

French machine-tool manufacturers (Intelautomatisme, SRCF[French Cylindrical Grinding Machines Company]-Gendron, SONIM [expansion unknown], or again Ernault-Toyoda, for instance) have a preference for Num numerical controls. However, they do have to use other controls (especially from Siemens or Fanuc) on exported machines. This shows that the French electronics and data processing industries involved in computer-integrated manufacturing must find their own outlets on the foreign market, independently of machine manufacturers.

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MICROELECTRONICS

BRIEFS

FRAUNHOFER INSTITUTE FOR MICROELECTRONICS--Microelectronics is achieving ever greater significance in terms of the economic future of the FRG. The systematic promotion of microelectronics, however, plays a decisive role in transforming areas of traditional heavy industry to areas involved in new technologies. The founding in 1984 of a Fraunhofer Institute for Microelectronic Circuits and Systems in Duisburg can also be viewed as playing such a role. The institute, which not only conducts basic research but also performs equal amounts of contract research for industry, began providing the full scope of its activities at the beginning of this year and now has 44 employees. The main areas of emphasis at the institute are circuits for the fields of measurement and control technology, communications, automotive electronics, medical technology, data systems technology and instrumentation and controls. With these areas the institute is already able to finance itself by about 70 percent from its own earnings. A new building for the institute will be completed in the near future; during the final phase of construction (beginning in 1988) the number of employees will be increased from 100 to 120. The institute represents a conscious political and structural step in furthering the economy of North Rhine-Westphalia. [Text] [Duesseldorf VDI NACHRICHTEN in German 10 May 85 p 1] 12552

CSO: 3698/9

SCIENTIFIC AND INDUSTRIAL POLICY

AREAS OF EUREKA RESEARCH BY PRODUCT, FIRM, COUNTRY

Paris L'USINE NOUVELLE in French 1-8 Aug 85 pp 10-11

[Article by Claudine Meyer: "FF 1 Billion for Eureka"]

> [Text] Today: official launching. In November: further detail on its financing. The European industry has four months to give Eureka its final content.

Francois Mitterrand is committed to depositing FF 1 billion into the account of the European technological program Eureka by 1986. Financing will be provided by the Industrial Modernization Fund for FF 300 million, and by the Ministry of Research and Technology and the Ministry of PTT [Post and Telecommunications] for FF 700 million. Will this FF 1 billion pledged by the government generate an additional FF 1 billion from French manufacturers? The financing conditions of the Eureka project will be tackled in November. However, as in the case of the data-processing program ESPRIT [European Strategic Program for R&D in Information Technology] adopted by the EEC in 1984 (FF 10 billion over 5 years), and the European RACE project [R&D in Advanced Communication Technologies for Europe] (FF 7 billion) designed to develop prototypes in the field of telecommunications, mixed financing provided by the states and by their industries might be the solution chosen.

For the time being, uncertainties remain: Great-Britain would like to see its industries commit themselves first. Only the FRG will be quick in following the French example: hosting the second Eureka meeting, it would in turn endow the program with FF 1 billion, i.e. approximately DM 300 million. All together, if we consider that France represents one fifth of the European gross national product, we may dream of a total budget of FF 10 billion for the first operating year, and FF 50-70 billion until 1992, the deadline for the completion of some Eureka projects.

An inventory of the projects was made by the Center for the Study of Advanced Systems and Technologies (CESTA) created in 1982, right after the Versailles summit, and headed by Yves Stourdze. In data processing and robotics, in telecommunications, biotechnologies and materials, Eureka projects have a single objective: to give enough muscle to the Europe of high technology to ensure its independence from the United States and Japan and prevent it from falling to subcontractor status.

Fallout for Five Major Industrial Sectors

	Interested French Companies	Public Organizations	European Partners	European Organizations
EUROCOM				
DP networks for research	Bull	MRT, CNRS, Inria		* Centres de recherche nationaux
Lge digital switching syst.	CIT-Alcatel	DGT, Cnet	Plessey, Italtel (Ital.), Siemens	
[illegible] and office-automation communications	CIT-Alcatel, Thomson	Cnet, PTT	British Telecom, GEC, Plessey, Italtel, Bundespost, Nixdorf, Siemens (RFA)	
Wide-band transmission	CGE, Câbles de Lyon, ESD, Matra, SAT	PTT, Cnet	ANT, Siemens (RFA), Plessey, Italtel, Selenia (Ital.)	
EUROBIO				
Artificial seeds	Clause, Elf-Aquitaine, Laffond, Limagrain, Rhône-Poulenc, Sanofi	CNRS, Inra, UT-Compiègne, Insa	SES (Belg.), De Danske Sukker Fabrikker (Dan.), AFRC, Agricultural Genetics Comp., Shell Nikkerson (G.-B.), Royal Sluis (P. B.), Hoechst, KWS (RFA), Ciba-Geigy, Sandor (Suisse)	Plant Genetic System, Université de Gand (Belg.), Institut Max Planck (RFA)
Control and reg. system	Elf Aquitaine		Behring, Siemens (RFA)	
EUROMAT				
Advanced-design industrial turbine	Alsthom, Ceravar, Hispano-Suiza, Rhône-Poulenc, SEP, Turboméca, Aubert et Duval, Imphy, Snecma, Framatome, Pechiney, Aérospatiale	Onera, CNRS	AME, British Ceramic, Herwell, Lucas, Rolls Royce (G.-B.), Alpha Romeo, Fiat, (Ital.), BBC, KHD, KWU, MTU Rosenthal Technik (RFA)	

Key:

SINTRA	Industrial Company for the New Radioelectric Technologies and French Electronics
ONERA	National Office for Aerospace Studies and Research
INRIA	National Institute for Data-Processing and Automation Research
CNRS	National Center for Scientific Research
IRISA	Institute for Data-Processing and Random Systems Research
INMOS	[expansion unknown]
GMD	Mathematics and Data-Processing Association
LETI	Electronics and Data-Processing Technology Laboratory
BASF	Baden Anilin and Soda Factory
ICL	International Computers Limited
AEG	General Electric Company
MBB	Messerschmitt-Boelkow-Blohm
CGE	General Electricity Company
CGEE	General Association of Electrical Companies
ESD	Electronique Serge Dassault

EUROMATICS	Interested French Companies	Public Organizations	European Partners	European Organizations
Lge vector comp. (30 Gflops)	Bull, Sintra (Thomson)	Onera, Inria	Siemens (RFA)	
Highly-parallel DP architectures	Bull, Sintra	CNRS, Inria, Onera		GMD (RFA)
Synchronous-architecture multiprocessor machines	Sintra, Thomson semiconducteurs	Inria-Insa, CNRS-Nice	Inmos (GB), Siemens	GMD
Mass memory	Bull	Leti	BASF, Siemens (RFA)	
Software engineering center	Aérospatiale, Bull, Cap Gemini, Renault	Inria, Mines Saint-Etienne	ICL, Logica, Scicon (GB), Philips (P.-B.), AEG, Dornier MBB, Siemens (RFA)	Université de Aachen (RFA)
Artificial intelligence	Amaia, Bull, CGE, CGEE-Alsthom, Cognitec, Copernique, ESD, Framentec, TITN	CEA, Cesia, Cnet, EdF, IEF, LRI, Paris VII	ICL, Inmos, LPA, SOL (GB), Olivetti (Ital.), Norsk Data (Norv.) Krupp, Siemens (RFA), Philips	Université d'Amsterdam (P.-B.), GMD
Dedicated circuits – symbolic machines	Amaia, Bull, CGE, CGEE Alsthom, Copernique, Matra, TITN, Thomson	Cnet, IEF	Inmos, Norsk Data, Siemens	Maia
Development tools for expert systems	Bull, CGE, Cognitec, ESD, Framentec	LRI-Orsay, Paris VII	IOL, LPA, SOL (GB), Technit, TXT (Ital.), Danet, Siemens (RFA)	Université d'Amsterdam (P.-B.)
Multilingual inf. system	Bull, CGE	Inria	ICL, Siemens	GMD (RFA)
Ind. process control	Aérospatiale, CGE	CEA, Cnes, EdF	Société Systems Europe (Belg.), Philips, Krupp, MBB, Siemens	
Europrocessor	Thomson	CEA, Leti, Cnet	GEC, Inmos Plessey, Philips, Siemens	
64-megabit memory	Thomson	CEA, Leti, Cnet	GEC, Philips, Siemens	
GaAs circuit plant	Chrismatec, Matra, Thomson	Cnet, CNRS	LME (Suede), GEC, Plessey, STC, Philips, Siemens	
Standard-cell circuit plant	Matra, Thomson	Cnet, Leti	GEC, Plessey, Philips, MBB, Siemens, LME	
EUROBOT				
Third-generation robotics	Bull, CGE, Dassault, Renault, Sagem, Sietam, Thomson	CEA, Cnes, Bremer, Inram Inria, Laas, Leti	FN (Belg.), GEC, Lamberton, Meta Machines, Taylor Hitec (GB) Ansaldo, Comau, Elsag, Mectron, Olivetti, RSE (Ital.), Fels, Fibro, Kuka, Siemens (RFA), Asea (Suede)	Programmes communautaires Brite et Esprit
Civil security robots	Camiva, G3S, Gec, Hispano-Suiza, Technicatome	ADI, CEA, CEA/Drep, Cen. Cesta CRNS, Inria	Taylor Hitec (GB), Fiat, Mectron (Ital.), IGM (Autriche)	
Agricultural robots	Renault	ADI, Cemagref, CNRS, Inria	Fiat (Ital.), Saab (Suede)	
Automated factory, CIM, CAD	Aérospatiale, Automatique industrielle, CGE, Matra Peugeot, Renault Automation, SGN, Sodeteg TAI	Adepa, ADI, CEA, Cen. Cesta CNRS, Inria	Fiat, Fer, Olivetti, RSE (Ital.), GEC Société générale de Belgique, Siemens, Asea	
CO, CO_2, excimer and free-electron laser	Alsthom, Cerco, CGP, Cilas, CIT, Etca, Framatome, Giat, IMFM, LDN, Matra Micro contrôle, SAN, Sopra, Thomson, Usinor	CEA, Cnet, Leti	CBL (Belg.), Ferranti, RSBE, Awre, JK Lasers (GB) Cama, Norks (Norv.), Ruhrs Union DFVLR, MBB, Garching (RFA)	

TITN	New Techniques for Information Processing
CEA	Atomic Energy Commission
CESIA	[expansion unknown]
CNET	National Center for Telecommunications Studies
EDF	French Electricity Company
IEF	[expansion unknown]
LRI	[expansion unknown]
LPA	[expansion unknown]
SDL	[expansion unknown]
MATRA	Mechanics, Aviation and Traction Co.
MAIA	[expansion unknown]
IDL	[expansion unknown]
RSE	[expansion unknown]
SOL	[expansion unknown]
TXT	[expansion unknown]
GEC	General Electric Company
LME	[expansion unknown]
STC	Storage Technology Corporation
IFREMER	French Institute for Research on Ocean Development
CNES	National Center for Space Studies
IIRIAM	[expansion unknown]
LAAS	Automation and Systems Analysis Laboratory
FN	[expansion unknown]
BRITE	Basic Research in Industrial Technologies for Europe
ESPRIT	European Strategic Program for R&D in Information Technology
ELSAG	San Giorgio Electronics
ASEA	Swedish General Electric Corporation
SAGEM	Company for General Applications of Electricity and Mechanics
G3S	[expansion unknown]
GIAT	Association of Land-Weapons Industries
ADI	Data-Processing Agency
OREP	[expansion unknown]
CERT	Toulouse Studies and Research Center
CESTA	Center for the Study of Advanced Systems and Technologies
IGM	[expansion unknown]
SAAB	Swedish Aircraft Company
SGN	General Company for New Technologies
SODETEG	Company for General Studies and Enterprises
TAI	Transmissions, Automation, Data Processing

ADEPA	Association for the Development of Automated Production
RSE	[expansion unknown]
CERCO	[expansion unknown]
CILAS	Industrial Company for Lasers
CIT	Industrial Telecommunications Company
ETCA	Central Technical Establishment for Armament
FRAMATOME	Franco-American Atomic Construction Company
IMFM	[expansion unknown]
LDN	[expansion unknown]
CBL	[expansion unknown]
RSBE	[expansion unknown]
DFVLR	German R&D Institute for Space Travel
MRT	Radio and Television Equipment
DGT	General Directorate of Telecommunications
PTT	Post and Telecommunications Administration
Bundespost	German Post Office
SAT	Telecommunications Company
ANT	[expansion unknown]
SANOFI	Aquitaine Financial Corporation for Hygiene and Health
UT	Technical University
INSA	National Institute for Applied Sciences
SES	[expansion unknown]
AFRC	[expansion unknown]
SEP	European Propulsion Company
AME	[expansion unknown]
BBC	Brown-Boveri and Company
KHD	[expansion unknown]
KWU	[expansion unknown]
MTU	[expansion unknown]
CGP	General Company for Computer-Integrated Manufacturing
L'UN	L'USINE NOUVELLE
*	National Research Centers

Indeed, individual firms can no longer afford the research budget required by leading-edge industries. According to Laurent Citti, CGE [General Electricity Company] development manager, "public telecommunications alone would require FF 1.5 billion per year. And even though CIT-Alcatel devoted 14 percent of its sales to R&D in 1984, these amounts are often inadequate in absolute value, compared to the U.S. manna."

It was therefore quite logical for Georges Pebereau's group to "enlist before call-up" for Eureka, and to sign an agreement on future telephone systems with the German Siemens, the British Plessey and the Italian Italtel by January.

Unfortunately, although these attempts to federate the Europe of telecommunications took place before the creation of Eureka, Eureka's baptism coincides... with the opening of negotiations between one of the four parties, Siemens, and the U.S. company GTE. A bad blow to European solidarity? At CGE, no one is taking offense. "It is a worldwide market," Laurent Citty explained, "and our European alliances should in no way prevent us from entering into others outside of Europe. Hence our own agreements, between Alcatel-Thomson and the U.S. Fairchild Industries, as well as, within the EEC, with the Italian Selenia and the German ANT [expansion unknown].

At Siemens, a more detached attitude: for its management, Eureka remains a "political project," that is vague both technically and financially. Therefore, the important agreement it signed with Japan, the other major power competing with Europe, is less of a surprise: the patent exchange that the German company is about to complete with Toshiba will enable it to market 1-megabit integrated circuits with a 1-year lead. And, at the Munich headquarters, people acknowledge that other major plans with the Japanese giant might well come off before the next Eureka meeting...

"Cohabitation among large groups is certainly not easy," people at Thomson acknowledge--in the context of Eureka, Thomson just got closer to Siemens and to the British General Electric Company and the Dutch Philips. "But they will have to learn to reconcile their agreements with other alliances signed with outside partners."

All these problems should clarify themselves progressively as the technological orientations of Eureka are identified and as it becomes necessary to deal among Europeans only... The first agreement signed in this context by MATRA [Mechanics, Aviation and Traction Company] and the Norwegian Norsk Data, 1 month ago, proves that tandems are formed when real synergism is present between partners: the compact vector computer that should be the outcome of this agreement will indeed require the Norwegian knowhow in the field of all-purpose computers and the French knowhow in that of VLSI chips.

Common interests also in the field of electronics. In 6 years, Europe saw its share of the world's semiconductors market decline from 15 to 10 percent. Only through a regrouping of its industrial forces will it be able to reach the critical size required to forge ahead. Especially since the budget required to develop the components of the future are estimated at some FF 50 billion. Complementing one another, the four electronics manufacturers of the Old Continent therefore did not wait long to follow the

example of MATRA and Norsk Data, pulling a joint research project out of their files. From the flat-panel screens dear to Philips to the microprocessors and high-density memories of interest to Siemens, and to the gallium arsenide and microwave-frequency components required for telecommunications and used by Thomson, there will actually be something for everybody.

This is the necessary condition to tone down the discrepancy between the official launching of Eureka and the ambitions of its assumed partners. If it can prevent French-French competition and costly struggles among Europeans and if it can progressively eliminate possible redundancies among research teams, that would already be a flattering result for a program that is still in gestation.

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SCIENTIFIC AND INDUSTRIAL POLICY

FRENCH MINISTER PRESENTS 1986 RESEARCH BUDGET

Paris AFP SCIENCES in French 26 Sep 85 pp 1-5

[Text] I. Policy and Organization of Scientific Research

Curien: "A good research budget in 1986."

Paris. On 20 September, Hubert Curien was an obviously happy man when he presented the research budget for 1986: more than Fr 42 billion, in today's francs, he stressed.

"Within a national budget which will be thrifty, our budget, which clearly demonstrates the priorities accorded to research by the government, fits very well into the 3-year research plan adopted by the National Assembly and which will be submitted to the Senate during the fall session," he declared. He had previously stated that Prime Minister Laurent Fabius was totally convinced of the necessity to modernize the country's industry through research and innovation.

For the Minister of Research and Technology, there is no doubt that, at the end of the decade, the goal of dedicating 3 percent of the GDP to R&D will be reached. This hope is all the more justified, he added, since in 1985 the share will be 2.29 percent and it will reach 2.4 percent the next year.

This 3 percent figure "has no magic or mythical significance," Curien stated, for "we want to be among the best and to be on the same level as the United States, the FRG and Japan."

With Fr 42,084 million awarded in program allocations and regular expenses, the research budget is among the most significant this year and has increased in value by 8.2 percent over 1985.

In all, the financial support granted to research by the government in 1986 is increasing by 14.2 percent. According to the minister, this corresponds to the funds needed to respond to the challenges of modernization of the country and of international competition.

The two pillars of French research will benefit: public research, which will continue to pursue its modernization and renovation of personnel and

facilities; and industrial research, which will be energized for the double venture of maintaining France in the top international rank in its three strong sectors--nuclear, space and aeronautics--and the rapid augmentation of the technological level in the entire industrial fabric.

Public research will benefit from the introduction of a long term scientific employment policy, characterized by a 5-percent recruitment rate for new researchers to compensate for retirements and by a constant requalification of personnel.

In all, 1,400 jobs will be created annually (725 researchers and research engineers, 675 engineers, technicians and administrators) to which 600 promotions will be added. Besides these measures, there will be reform of the thesis system and creation of a research network for medical and pharmacy interns.

There is only one problem--mobility of researchers is not improving, not to say that it is stagnating. This mind set needs to be changed, according to the minister.

Overall, the finances of the laboratories will increase by 12.6 percent, with a characteristic growth of "moyens mi-lourds"*(21.8 percent) and calculational data processing funds (17.2 percent).

Industrial research is going to received serious incentives, according to Curien. Significant technological development programs will show sharp movement next year.

For example, the size of the electro-nuclear program is unchanged, but basic research and finalized research will see sustained growth at the CEA (Atomic Energy Commission) which will have a budget of more than Fr 7 billion. Like aeronautics, space will reach a peak: the CNES [National Center for Space Studies] which is to continue development of the "Ariane IV" rocket will again have a budget in the neighborhood of Fr 5 billion.

By doubling the tax credit for businesses, the government is demonstrating the confidence it is placing in them to develop their research effort. In 1986, this will represent more than Fr 1 billion which will be shared by 2,000 firms. In addition to this, there are the innovation grants distributed by ANVAR [National Agency for Implementation of Research] which will increase by 8.8 percent.

As proof of its desire for the success of the "Eureka" project for a technological Europe and according to its promise to appropriate Fr 1 billion for it next year, the civilian research budget allocated Fr 500 million in credits, to which are added Fr 200 million from the PTT [Post, Telegraph and Telephone] supplementary budget outside the civilian research budget and Fr 300 million from the industrial and modernization fund.

All told, concluded Curien, during the first year of the 1986-88 3-year research plan, national R&D expenditure should exceed Fr 115 billion.

*[translation unknown]

Breakdown of 1986 Budget Allocations
by Organization and Ministry

Ministry of Research and Technology	Regular Expenses 1986	Program Allocations 1986	Regular Expenses + Program Allocations 1986	Overall Change 1986/1985
CNRS (+IN2P3 + INSU) [National Center for Scientific Research (+Expansion unknown + Expansion unknown)]	6,652.3	2,298.6	8,950.9	+ 8.4%
INSERM [National Institute for Health and Medical Research]	1,055.0	565.6	1,620.6	+ 8.9%
INRA [National Agricultural Research Institute]	1,775.3	457.6	2,232.9	+ 8.2%
CEMAGREF [Expansion unknown]	36.6	39.1	75.7	+13.8%
ORSTOM [Overseas Scientific and Technical Research Office]	526.7	186.0	712.7	+10.3%
INRETS (ex IRT) [Expansion unknown]	101.9	43.9	145.8	+ 7.6%
Institut Pasteur (Paris)	124.4	101.1	225.5	- 2.6%[2]
Institut Pasteur (Overseas)	17.7	8.8	26.5	+ 9.0%
Institut Pasteur (Lille)	-	18.6	18.6	+32.9%
Institut Curie	16.3	10.0	26.3	+19.0%
CNES [National Center for Space Studies] (regular expenses)	637.5	-	637.5	+11.6%
College de Philosophie	3.3	-	3.3	(new)
CEA [Atomic Energy Commission]	4,773.0	2,271.0[1]	7,044.0	+ 2.7%[1]
AFME [French Energy Control Agency]	33.5	315.2	348.7	- 3.7%

(Organization)	RE 1986	PA 1986	RE+PA 1986	Change 86/85
CESTA [Scientific and Technical Studies Center in Acquitaine]	23.5	6.4	29.9	+19.6%
IFREMER [Expansion unknown]	318.8	493.0	811.8	+11.0%
CIRAD [Expansion unknown]	369.6	133.2	502.8	+14.9%
ANVAR [National Agency for Implementation of Research]	156.1	990.0	1,146.1	+ 8.8%
La Villette	565.0	82.0	647.0	n.a.[2]
Joint services (with MRICE [Expansion unknown]) and School of Mines	241.2	36.3	277.5	- 5.2%[2]
Studies and C.P.E. [Expansion unknown]	-	17.0	17.0	+11.0%
Research and Technology Foundation (exclusive of electronics)	-	1,071.5	1,071.5	+11.6%
Data Processing and Communication	-	108.4	108.4	+69.9%
Provisions for Statutory Reforms: Regional Centers, Research Allocations, Training	506.7	-	506.7	+23.8%
Subtotal	17,934.4	9,253.3	27,187.7	+ 6.2%[4]

Ministries	RE 1986	PA 1986	RE+PA 1986	Change 86/35
MRICE [Expansion unknown] (BRGM [Geological and Mining Prospecting Office], BNM [National Office of Meteorology], Maritime Supply)	108.1	127.3	235.4	+18.1%
Ministry of Agriculture (ACTA [Association for Coordination of Agricultural Technology], ACTIA [Expansion unknown], A-A [Expansion unknown] Network)	79.3	42.7	122.0	-
Ministry of Culture	123.3	65.0	188.3	+16.7%
Secretary of State/DOM-TOM [Overseas Departments and Overseas Territories]; TAAF [French Austral and Antarctic Lands]	25.3	15.7	41.0	+ 9.6%
Secretary of State/Consumption	0.5	1.5	2.0	(new)
Ministry of National Education	216.5	1,405.6[3]	1,622.1	+26.2%[3]
Ministry of Environment	7.7	50.1	57.8	+ 5.3%
Ministry of the Interior and Decentralization	0.4	8.5	8.9	+18.7%
Ministry of Justice	2.1	3.4	5.5	+ 5.8%
Secretary of State/MER [Expansion unknown]	1.3	13.4	14.7	(see MRICE)
Ministry of Planning	43.9	12.9	36.8	n.a.
Ministry of External Relations	770.2	-	770.2	- 2.0%
Ministry of Cooperation	-	39.0	39.0	+104.2%
Ministry of Social Affairs and National Solidarity (MIRE [Expansion unknown], INED [National Institute for Demographic Studies])	71.0	30.2	101.2	+17.1%
Ministry of Labor (EEC)	15.8	4.6	20.4	+ 7.9%
SGPM (especially IFRI) [Expansion unknown]	11.8	6.5	18.3	+24.5%

(Organization)	RE 1986	PA 1986	RE+PA 1986	Change 86/85
Ministry of Urbanization, Housing and Transportation (LCPC [Central Laboratory for Bridges and Highways], CSTB [Center for Scientific and Technical Building Research], IGN [National Geographic Institute])	201.9	162.0	363.9	- 5.7%
Secretary of State/Transportation (PDT [Expansion unknown], Aeronautics, EERM [Center for Meteorological Study and Research], LCPC [Central Laboratory for Bridges and Highways])	95.2	2,856.3[1]	2,951.5	+20.1%[1]
Joint Responsibilities (EPPV)	56.1	116.0	172.1	n.a.[2]
Subtotal	1,830.4	4,960.7	6,791.1	+21.4%[4]

PTT Ministry (Supplementary Budget)	RE 1986	PA 1986	RE+PA 1986	Change 86/85
CNES [National Center for Space Studies] (program allocations)	-	4,210.0[1]	4,210.0	+23.0%[1]
ADI [Data Processing Agency]	35.0	200.0	235.0	-11.8%
INRIA [National Institute for Data Processing and Automation]	147.0	101.0	245.0	+11.2%
CESIA [Expansion unknown]	18.0	14.0	32.0	+ 2.2%
Electronics Sector (including FRT [Research and Technology Foundation])	-	2,350.0	2,350.0	+23.8%
Capital Allocation	-	1,000.0	1,000.0	-13.4%
Subtotal	200.0	7,875.0	8,075.0	+15.5%[4]
Supplementary Budget for Space Flight	-	30.0	30.0	+11.1%
Total Allocations (Program Allocations + Regular Expenses) Included in the Civilian R&D Budget	19,964.8	22,119.0	42,083.8	+ 8.2%[5]

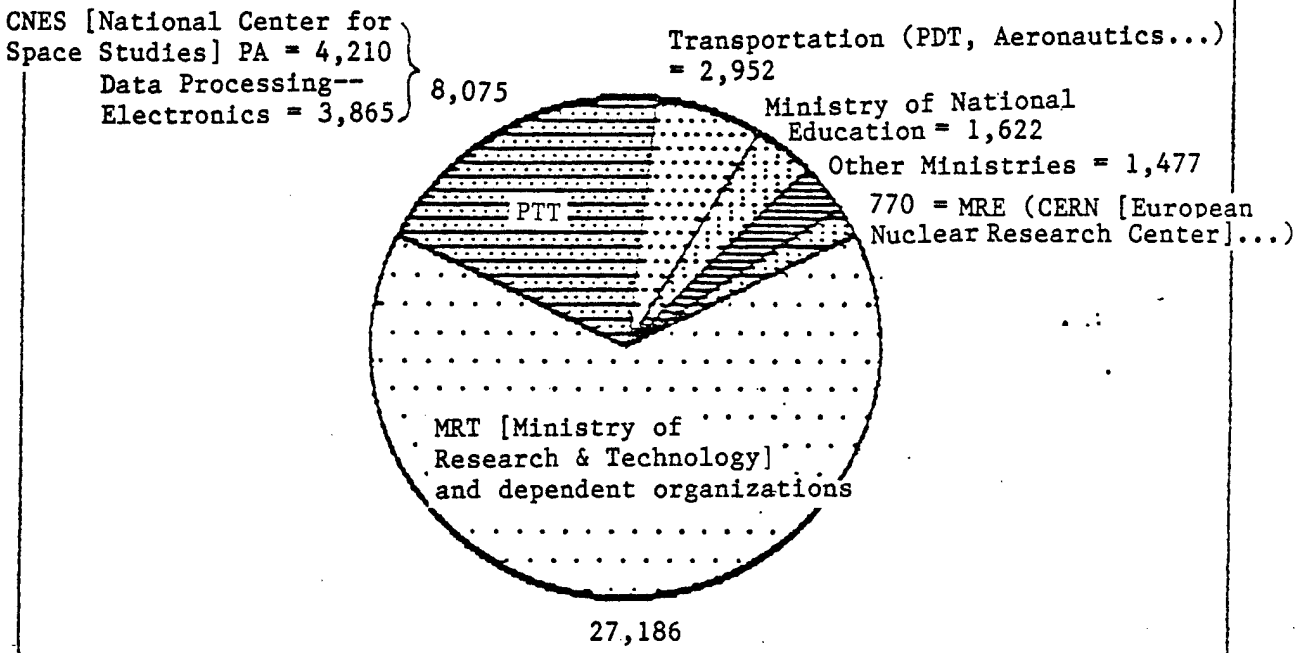
1. External financing is in addition to this
2. Completion of facility construction
3. After transfer of Fr 184,000 (university laboratory infrastructures)
4. Excluding Villette
5. Including Villette

Increase in the Civilian R&D Budget (In Millions of Francs)

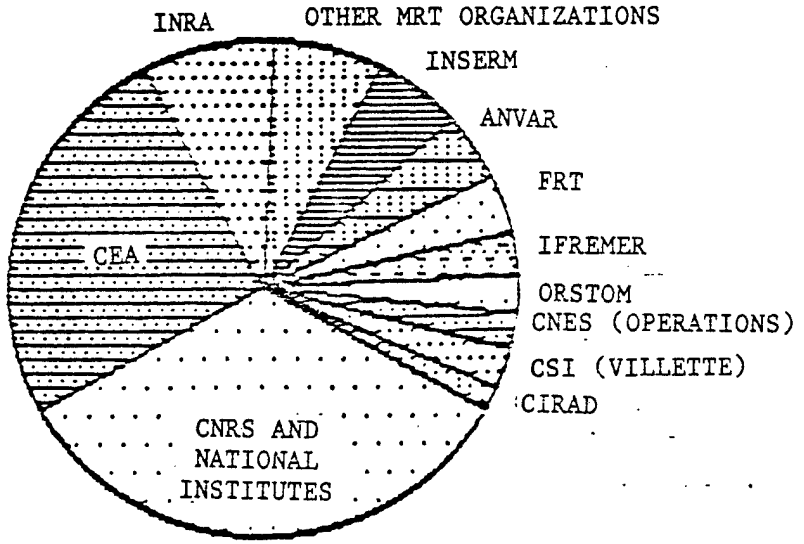
Civilian R&D Budget	LFI 1985[1]	LFI 1986[2]	Change	National Budget Change[3]
Regular expenses	18,443	19,965	+ 8.3%	+ 3.6
Program allocations	20,445	22,119	+ 8.2%	+ 12.0
CP [Expansion unknown]	18,285	21,028	+ 15.0%	+ 2.5%
RE + PA	38,888	42,084	+ 8.2%	+ 0.6%
RE + CP	36,728	40,993	+ 11.6%	+ 3.4%
Tax credit	400	1,040	no meaning[4]	-
External financing	300	705	no meaning	-
Total (RE + PA)	39,588	43,829	+ 10.7%	-
Total (RE + CP)	37,428	42,738	+ 14.2 %	-

1. Initial finance bill
2. After transfer of Fr 184 million (infrastructure credits for university libraries)
3. Excluding public debt
4. Meaningless statistics: change of 160 percent due primarily to the doubling of the tax credit rate

PRINCIPAL MINISTRIES IN THE CIVILIAN R&D BUDGET
(Civilian R&D Budget = Fr 42,084 million)



PRINCIPAL ORGANIZATIONS OF THE MRT
(RE + PA = Fr 27,188 million)



SCIENTIFIC AND INDUSTRIAL POLICY

DETAILED BREAKDOWN OF FRG 1986 R&D BUDGET

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 12 Sep 85 p 7

[Article: "Prime Objective Is Improvement of Basic Conditions: Proposed 1986 Budget of the Federal Ministry for Research and Technology"]

[Text] (TN) Frankfurt--About DM 52 billion will have been made available for R&D in the FRG in 1985. Of that amount about DM 12 billion are earmarked for federal spending and about DM 7 billion of this sum in turn are allotted to the Federal Ministry for Research and Technology (BMFT). According to the government proposal the BMFT budget will amount to DM 7.45 billion in 1986 or 14 percent of the money spent on research, assuming a total figure of about DM 54 billion spent on research in the FRG in 1986. Therefore, the research budget plays an important role in the FRG in the area of R&D, particularly with regard to basic research.

A basic outline of the 1986 research budget is given in Table 1.

According to research policy objectives, as stated most recently in Federal Research Report VII, state efforts in support of research are concentrated in the areas of
- basic research
- research on maintaining and improving living conditions
- key technologies and basic conditions within the economy with regard to R&D

The program decisions made in the past few years provide a clear outline of the BMFT budget; these programs involve environment and ecology, information technology, materials research, biology and the individual decisions regarding a new generation of large-scale equipment for basic research, such as the construction of the European transonic wind tunnel, the basic decision to go ahead with a continental deep well drilling program and Germany's participation in the Ariane V launch vehicle and the space station Columbus. These are forward-looking areas, and new knowledge ensures new jobs.

Basic research is also granted a high priority in the 1986 budget. It increased by 29.47 percent from 1982 to 1985 and by an additional 8.9 percent from 1985 to 1986. Due to its scientific and general cultural significance and the perspective which it contains with regard to technical innovation,

this percentage was again increased. After being 27.4 percent in 1982 and 34.3 percent in 1985 this percentage is anticipated to reach 36 percent in this part of the 1986 budget. The spallation neutron source project, the total cost of which was estimated at DM 2.95 billion (without international participation), was turned down. All other projects suggested by the Pinkau Commission have been approved and are under construction or still being negotiated.

Of particular note is the area of specialized information with a rate of increase of 23.9 percent (DM 114.4 million in 1986). Noteworthy in terms of volume is the 20 percent decline in nuclear energy research which in 1986 still accounts for 16.8 percent of the overall budget of the BMFT as compared to 21.8 percent in 1985. The absolute figures in the outline of the research budget clearly show the restructuring of research support with regard to the infrastructure technologies.

In 1986 spending in the key technologies (not including energy research) will increase to DM 1.97 billion, thus amounting to 26.5 percent of the overall budget. The rate of increase of 17.3 percent indicates that the federal government is looking toward the future. In conjunction with the economic and scientific sectors this should provide incentives for new technologies. In particular these new technologies are information technology (+16.5 percent), biotechnology (+29.4 percent) and physical technology (+22.6 percent).

An important feature of the new budget is an increase in the available resources for improving basic conditions for research, development and innovation within the economic sector. In the coming year these funds will amount to DM 249 million, a 44.6 percent increase over 1985. These include:

- the TOU (founding of technology-oriented companies) model experiment, DM 70.8 million (+18 percent)
- support for newly hired R&D personnel within the economic sector (dependent on approval by the EC commission on support for growth), DM 110 million (+100 percent)
- additional measures for promoting cooperation between the scientific and economic sectors in the field of R&D, DM 68.2 million (+19.2 percent)

The structural change in research support by the BMFT becomes evident when one looks just at those areas in which there is an increase in spending for 1986. Table 2 lists these areas [as published].

The restructuring of research support within the 1986 budget is even clearer when one looks at those areas in which spending will decrease in 1986. Some examples are:

- nuclear energy research (28.3 percent)
- renewable energy sources, efficient energy use (12.1 percent)
- coal and other fossil fuels (6.8 percent)
- securing raw materials (29.7 percent)
- water-related research (desalination of seawater, 17.6 percent)
- chemical process technology (14.8 percent)

The 1986 BMFT budget shows that the research policy set forth in the 1984 federal research report has been effectively translated into action. The basic theme of providing greater initiative in all areas from basic research to support within the economic sector is repeatedly in evidence.

Table 1 Outline of Proposed 1986 BMFT Budget (including large-scale research facilities according to the 1984 disposition key and taking into account the special developments, HERA, SIS and BER II)

Area Outlined/Main Support Area	1985 budget in millions of DM	1986 budget in millions of DM	1986 changes over 1985 in percent	1986 percentage of overall budget in percent
I. Basic Scientific Programs	(1317.8)	(1493.5)	(+13.3)	(20.0)
1. Basic financing, Max-Planck-Gesellschaft (MPG)	407.8	419.7	+ 2.9	5.6
2. Selected areas of basic research in the natural sciences	826.5	978.4	+18.4	13.1
3. Geosciences (especially deep well drilling)	21.6	27.3	+26.4	0.4
4. The arts and social sciences	61.9	68.1	+10.1	0.9
II. Long-Term Federal Programs	(1139.9)	(1297.4)	(+13.8)	(17.4)
1. Space research and technology	821.9	967.1	+17.7	13.0
2. Marine research	83.7	82.1	- 1.9	1.1
3. Polar research	64.4	73.6	+14.3	1.0
4. Nuclear fusion research	169.9	174.6	+ 2.8	2.3
III. Living Conditions (Preventive Research	(735.3)	(769.3)	(+ 4.6)	(10.3)
1. Ecological research	122.1	131.2	+ 7.5	1.8
2. Environmental protection technology	135.0	144.4	+ 7.0	1.9
3. Water-related research	30.2	25.7	-14.9	0.3
4. Climate research	21.1	26.7	+26.5	0.4
5. Safety research	9.0	10.0	+11.1	0.1
6. Health-related research	243.8	253.0	+ 3.8	3.4
7. Humanizing the working world	103.5	106.6	+ 3.0	1.4
8. Estimating impact of new technologies (insofar as not already included in other support areas)	14.2	15.2	+ 7.0	0.2
9. Interrelated activities	56.4	56.5	+ 0.2	0.7
IV. Infrastructure Technologies	(2347.5)	(1983.7)	(-15.5)	(26.6)
1. Coal and other fossil fuels	315.5	295.9	- 6.2	4.0
2. Renewable energy sources; efficient energy use	208.0	186.2	-10.5	2.5
3. Nuclear energy research	1568.3	1255.0	-20.0	16.8
4. Transportation research	189.5	191.6	+ 1.1	2.6
5. Securing raw materials	29.9	21.0	-29.7	0.3
6. Construction research	36.3	34.0	- 6.3	0.5

Table 1 (cont.)

Area Outlined/Main Support Area	1985 budget in millions of DM	1986 budget in millions of DM	1986 changes over 1985 in percent	1986 percentage of overall budget in percent
V. Key Technologies, Basic Conditions for R&D	(1681.1)	(1972.7)	(+17.3)	(26.5)
1. Marine technology	79.8	77.2	- 3.3	1.0
2. Information technology (including production engineering	662.5	771.9	+16.5	10.4
3. Biotechnology	135.9	175.8	+29.4	2.4
4. Materials research (not including the expiring special steel research program)	162.1	176.0	+ 8.6	2.4
5. Chemical process technology	12.5	10.7	-14.8	0.1
6. Physical technologies	61.9	75.9	+22.6	1.0
7. Aviation research	170.6	196.8	+15.4	2.6
8. Basic financing, Fraunhofer Gesellschaft (FhG)	114.9	125.0	+ 8.8	1.7
9. Specialized information	92.3	114.4	+23.9	1.5
10. Innovations and improvements in overall economic conditions (personnel increases, TOU, transfer of technology and knowhow)	172.2	249.0	+44.6	3.3
VI. Administration	51.6	53.1	+ 2.9	0.7
VII. Across-the-Board Reduction of Expenditures (by achieving savings within the main support areas in implementing the budget)	-80.0	-120.0	+50.0	- 1.6
Total BMFT Budget:	7193.2	7449.4	+ 3.6	100.0

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SCIENTIFIC AND INDUSTRIAL POLICY

SMALLER FIRMS ACQUIRE CAPITAL MORE EASILY WITH FRG DRAFT LAW

Duesseldorf VDI NACHRICHTEN in German 3 May 85 p 7

[Article by R. Sietmann: "Financing. 'Fresh Cell Therapy' for Companies: Bonn Wants to Mobilize Private Capital With New Law"]

[Text] The venture capital business in the FRG now contains a new element. The FRG government wants to combat the chronic drain on the capital resources of small and medium-sized firms with a bill concerning company investment corporations.

The inadequacy of the capital resources of small and medium-sized firms in the FRG has been a subject of complaint for years. According to the Deutsche Bundesbank the amount of their own capital invested by firms fell from just under 30 percent of the total two decades ago to only 18.5 percent in 1983 and has developed into a serious hindrance to investment. The lack of available capital within a company narrows the credit options. An appropriate capital base is of decided importance in terms of the ability of an enterprise to compete, making it easier for it to adapt to changing economic, structural and technological conditions in the marketplace.

The bill concerning UBG's (company investment corporations) proposed by the federal minister of finance and approved by the cabinet is supposed to act as a kind of "fresh cell therapy" in terms of company financing.

Large firms, of course, have little difficulty meeting their investment capital needs because the vast majority are organized as legal entities called corporations and can thus obtain refinancing via the stock exchange. Small and medium-sized firms and young companies not listed on the stock exchange, on the other hand, have no corresponding reliable market for investment capital at their disposal. This is about to change. With this bill the FRG government, in addition to creating an improved private capital structure, hopes also above all to provide the private investor in the mid-range income bracket with an alternative which will pave the way for him to invest smaller amounts in companies not listed on the stock exchange.

With this new type of organization, the UBG, this will take place indirectly: The investor acquires shares in this corporation and thus makes his capital immediately available to the companies in which the UBG has holdings. The UBG

therefore acts as a middleman between the stock exchange as a functional market for direct investment capital and the companies (still under certain circumstances) not qualified to trade on the stock exchange. This is primarily what distinguishes the UBG from the usual KBG (equity investment company) which does not as a rule refinance itself through the sale of shares.

More Investment in Productive Assets

Conventional, profit-oriented equity investment companies--usually subsidiaries of credit institutions--are generally financed by means of credit from their parent banks or through trust assets which are made available and therefore must cover their costs many times over by contracting with the investment companies for a profit-generating fixed interest rate. Those KBG's, however, which offer exclusively publically promoted capital investments can rely on low-cost refinancing and conditional guarantees from the state.

In the future--if the bill becomes law, and no one doubts that it will--a clear differentiation will have to be made between "company investment corporations" and "equity investment companies." A UBG can not just organize itself as a stock corporation--this title can be granted only after a petition is submitted. There are good reasons for such a step--such a status is linked to tax advantages. While the special assets administered by traditional capital investment companies are not subject to corporate, trade and property taxes (the investor should not be subject to higher taxes because he makes investment funds available), direct investments in companies not qualified to be listed on the stock exchange have up to now meant additional tax burdens for the investor.

In order to make the purchase of shares in a UBG attractive to private investors and put them on the same level as direct investors, the company investment corporations will not be subject to property taxes or to the trade tax. Recognition of these corporations and the attendant tax advantages are of course linked to certain requirements. Thus legal requirements regarding diversification in terms of the investments accepted and the investment boundaries are necessary in order to limit the commercial risks. KBG's which want to become UBG's must become stock corporations and must offer up at least three-quarters of the shares for public adquisition within eight years of being accepted as a stock corporation.

The bill allows collective bargaining bodies to found UBG's and to offer its shares to the employees within that collective bargaining area, even within the scope of capital-forming efforts, thus promoting employee investment in productive assets.

In the final analysis it is the investors who will decide whether the "double strategy" of the FRG government will succeed by creating an alternative to the savings account and builder-owner models on the one hand and on the other hand by improving the availability of private capital for small and medium-sized firms. That the federal finance office, because of the tax benefits provided, will review the activities of the UBG's (and in the case of violations of the legal obligations is even able to levy fines) does not mean, however, that the

state provides any guarantees as to the soundness of the new companies or the profitability of its shares or its individual investment decisions.

This law does not mean that a critical examination by the investor himself of a capital investment with these companies can be dispensed with. There is no such thing as a no-risk venture.

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SCIENTIFIC AND INDUSTRIAL POLICY

BRIEFS

DANISH INTEREST IN EUREKA--Biotechnology and electronics firms make up the majority of the more than 100 Danish companies which wish to take part in EUREKA, the large technological research project initiated by France. Christian Rovsing, Regnecentralen, and Soren T. Lyngsoe are among the firms which have applied to the Office of Research, but small and medium-scale businesses also want to participate. The size of the contribution of the Danish government is still uncertain. It depends on how large an amount the Danish firms themselves plan to earmark for the research project. Minister of Education Bertel Haarder, who has been given the unofficial title of Minister of Research, and Minister of Industry Ib Stetter will discuss the plans to join EUREKA in greater detail at a meeting on Wednesday, 30 October. [Text] [Copenhagen BERLINGSKE TIDENDE in Danish 25 Oct 85 Sec III p 4]

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TECHNOLOGY TRANSFER

FRENCH-SOVIET COOPERATION IN SPACE VENTURES DETAILED

Paris AFP SCIENCES in French 26 Sep 85 pp 21-26

[Text] Marseille. Detailed examination and interpretation of the data collected by the two probes VEGA 1 and VEGA 2 and their balloons has barely begun, but French and Soviet specialists are starting work again in preparation for a new Venus mission for the eighties with extensions toward the principal asteroid belt and the comets for the following 10 years. Venus now and forever, as it were... since it was not possible to finalize plans for an ambitious manned flight project leading to another flight of a French astronaut with some Soviets.

Manned Flight: Still No Decision

Nothing has been decided yet about the possible flight of one of the three new astronauts from the CNES [National Center for Space Studies] on board a Soviet station, whether it is of the Salyut type or from the new generation.

"Such a flight was not on the agenda. It was certainly discussed officiously among specialists but only informally," Jacques Louis Lions, director of the CNES, emphasized during a press conference marking the end of a week of talks between delegations from the two countries.

It remains to be seen whether such a possibility will be brought up during the talks at the beginning of October on the occasion of Mikhail Gorbachev's trip to France.

French specialists would like to be allowed a long flight, of at least a month, in order to round out the data successively collected, with the help of the "echography" and "posture" experiments, on Jean Loup Chretien in 1982 and then on several Soviet cosmonauts having lived on board the Salyut 7 as well as on Patrick Baudry during his weeklong flight on board the American shuttle Discovery.

Perfection of the "Ace of Hearts", a third generation echograph is nevertheless proceeding at the laboratory of Professor Leandre Pourcelot in Tours. A mock-up already exists. The Soviets are still using the echograph taken aboard Salyut 7 by Jean Loup Chretien.

"This device is still a good medical and biological calling card," Professor Gaston Meyniel emphasized. "The results achieved permit enlargement of the research field and foreshadow a new experiment with NASA. We discussed the possibility of a new experiment with the Soviets who can come familiarize themselves with the new device in France. A final decision about this could be made within a year, but it does not imply an additional manned flight."

The selection of commanders Jean Pierre Haignere and Michel Tognini and engineer Jean Francois Clervoy for a flight on a Soviet ship will in all likelihood fall between 1987 and 1991, according to Lions.

Nothing has been finalized, far from it; and, among the specialists, no one was hiding the fact, in Marseille or in Paris, that an agreement on such a flight would depend above all on the "politicians."

The Soviets have not yet placed their new orbital station in orbit. It is not known when they will, perhaps next year. The refitting of the Salyut 7 and the arrival of a new three-man team on board it permitted the academician Alexandre Kotelnikov to avoid any specific response about this.

Gamma Astronomy, Mars, Space Biology and Venus

Within the framework of French-Soviet space cooperation (Fr 61.8 million in the CNES [National Center for Space Studies] budget for 1985), work is actively continuing on a number of projects.

a. Gamma Radiation

The major activities here are the two astronomy projects GAMMA-1 and SIGMA. The respective launches of these cooperatively produced devices are scheduled during the first half of 1986 and at the end of 1987. Both are intended to establish a mapping of galactic and extra-galactic sources of gamma rays, to determine their origins and their distribution as well as their temporal variations and their spectra.

These two projects will amount to making gamma imagery with an angular precision never attained previously, stressed Genevieve Debouzy, who has been responsible for them from the beginning. To these will be added the continuation of a program studying gamma bursts with experiments placed on Soviet vehicles expected to be launched in 1988.

b. Mars and Phobos

The next Mars mission, in 1988, will have a three-fold objective: the study of Mars from various orbits, the study of the Sun during the flight toward the red planet and again after fly-by and finally the study of the Martian satellite Phobos.

The detailed plan for this mission will be the subject of a special protocol which should be signed soon. It could include establishment of a long term autonomous station able to land on the satellite Phobos. Two Martian probes will be sent toward Mars in 1988 with each carrying many French and Soviet

scientific instruments according to Professor Viatcheslav Balebanov, assistant director of the IKI [expansion unknown].

Each would release a landing module toward Phobos equipped with ionic laser sources to vaporize the surface of the satellite to permit analysis of the types of rock there. According to this specialist, Phobos probably is actually an asteroid captured by Mars--the study of which will be all the more interesting for that. The orbiters would also be equipped with radar to study the internal structure of the red planet and its satellite from a certain distance. Studies of the Martian atmosphere will also be made during the mission as well as others dealing with solar oscillations .

c. Three other important experiments are scheduled for the coming months:

-INTERBOL, for the study of the magnetosphere, the implementation of which is set for 1988-89,

-COMET, for in-orbit gathering of extraterrestrial substances, based on the Salyut station, scheduled for the month of October on the Giacobini-Zinner Comet and on Halley's Comet in March 1986.

Conceived by the Rene Bernas laboratory of the Center for Nuclear Spectroscopy and Mass Spectroscopy in Orsay, this experiment is intended to determine the elemental and isotopic composition of the comet material, granule by granule, comet by comet for a certain number of favorable comets. It ought to contribute to knowledge of the origin and the primitive evolution of the entire solar system.

The four catchment cases were installed on 2 August on the outside of Salyut 7 by cosmonauts Vladimir Djanibekov and Viktor Savinykh. They will be opened either manually or automatically by the members of the team at the station during the first 2 weeks of October in the case of the Giaccobini-Zinner Comet, then next March for Halley's Comet, and the cases will be returned to Earth aboard Soyuz vehicles.

d. Space Biology and Medicine

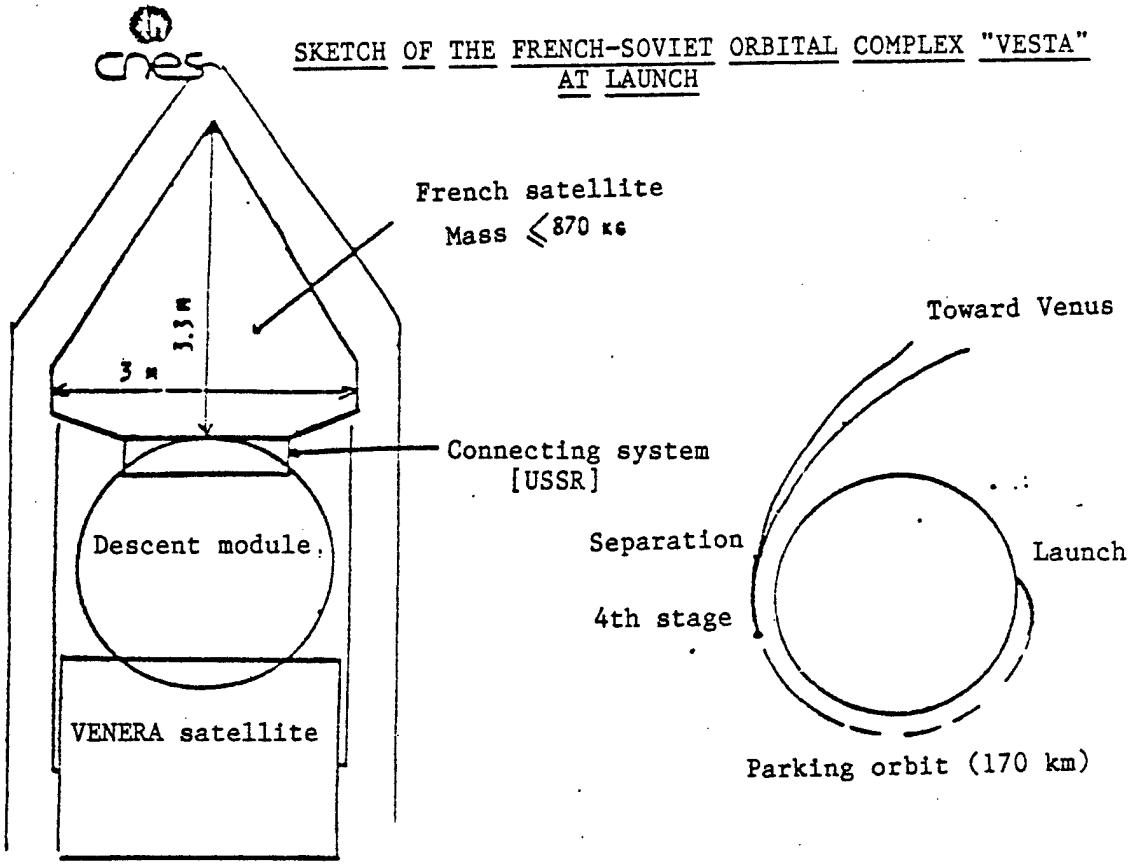
Experiments in this area will continue on the Soviet biological satellites. Just recently, an experiment on glucose metabolism was carried out. It will be pursued during coming flights by cosmonauts.

Venus Now and Forever

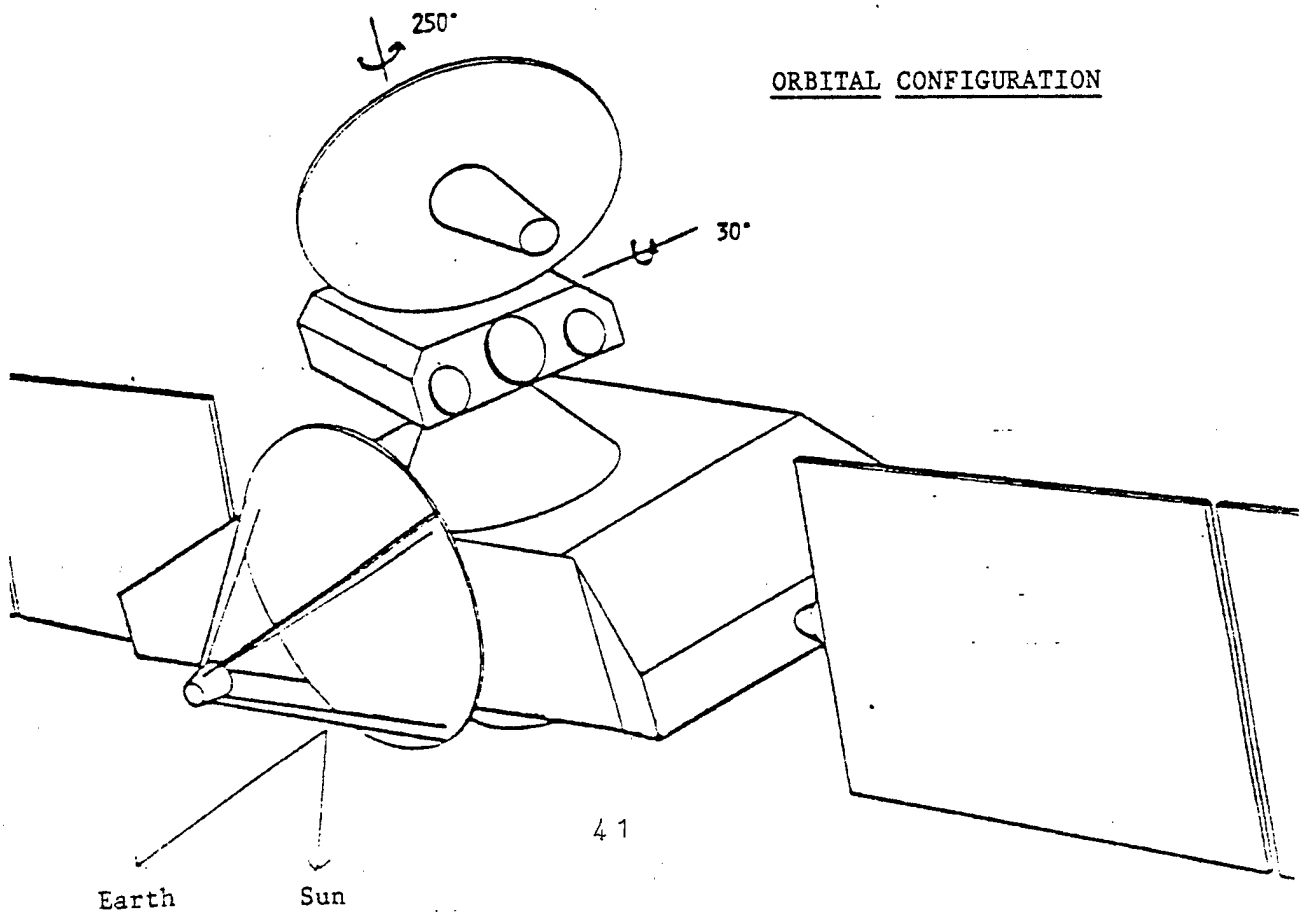
The VESTA project is going to replace the VEGA program in French-Soviet cooperation and will be the basic element of it in the coming 8 years according to Lions and Kotelnikov.

It has, in fact, very ambitious goals. Current studies are directed toward the successive launch of multiple French and Soviet automated probes about 1992-93. Some of them, like the VEGA probes, would have Venus proper as an objective; the others were directed by complicated trajectories toward small bodies in the solar system: asteroids and comets.

SKETCH OF THE FRENCH-SOVIET ORBITAL COMPLEX "VESTA" AT LAUNCH



ORBITAL CONFIGURATION



This VESTA project will be quite expensive and will represent a technological challenge of the first magnitude for the French. In fact, it ought to permit the French to construct their first automated interplanetary probe, to oversee its remote guidance, etc....

The mission's definition is still being developed. It is currently in phase A, which does not permit determination of the actual cost of the project. But a definitive decision ought to be made as soon as possible, at the time of the next meeting of the French-Soviet space commission in September/October 1986 in Moscow at the latest.

To launch this group of probes, it seems that a more substantial launcher than those used to propel the VEGA probes will be needed. In fact, the project is quite complex. According to Yves Langevin at Orsay, it will actually be a matter of simultaneously launching a probe to explore Venus and the French probe--800 to 900 kilos--intended to examine closely, that is, to encounter asteroids from the main belt and low-activity comets.

The primary interest in the project consists of the fact that, within a period of a few years, thanks to a trajectory establishing a parking orbit around the Earth (at an altitude of 170 kilometers) and the slingshot effect from Venus, the French probe would travel to explore from six to eight different asteroids.

Current plans include, for example, a 10 January 1993 launch, a fly-by of Venus by the Soviet probe on 13 May of the same year, an additional fly-by of the Earth in elliptical orbit on 14 March 1994, then a departure for 13 Egeria flying by on 13 August 1995, the fly-by of 37 Fides on 18 June 1997, then of 40 Harmony on 4 April 1998, all within 5 years and 3 months.

According to Professor Barsukov of the academy of sciences of the USSR, a specialist in geochemistry, the study of small bodies in the principal asteroid belt would quite possibly permit discovery of original matter, the substance from which the planets, including Earth, were formed.

Optical study of such asteroids from a distance would itself be a first. If a low-speed encounter could be achieved, the presence aboard the French probe of a double "penetrator" of a device for geological analysis would be even more significant.

As for Venus, the VESTA project should permit new advances in the knowledge of its geological structure and of its atmosphere. It should, for example, permit determining whether or not there was ever water on Venus and what the chemical composition of its soil is. To date, thanks to the seven Soviet landings and the data from the American Pioneer-Venus, three major types of rock are known. It seems as though there are actually seven or eight types, resulting from a very complex geology.

That, according to Professor Barsoukov, makes it necessary to increase the number of landings at quite distinct sites. The nature of the atmosphere near the surface of the planet is to date unknown. No one knows the origin of

the violent currents which shook up and perturbed the movement of the two balloons released last 11 and 14 June at an altitude of 55 km by the VEGA-1 and VEGA-2 probes, etc....

Exploration of the small bodies in the solar system is of great interest, according to the specialists, since it should permit rounding out the close observation of the objects constituting the solar system, obtaining data about the primary stages of its formation, defining the relationship between meteorites, asteroids, micrometeorites and comets and thus coming to know the most significant and most varied source of extraterrestrial material.

Fly-by of an asteroid of the principal belt as planned within the framework of the VESTA project should permit discovery of the general characteristics of these bodies: size, shape, period and axis of rotation, density and even information about their internal structure.

At the same time, it would be possible to study their morphology and their surface characteristics, from the possible existence of a layer of debris to the physics of collisions and the origin of meteoritic breaks. Also studied would be the mineralogical composition at the surface, the environment (magnetic field, satellites, comet activity) and more would be learned about the characteristics of the interplanetary milieu.

As for the part of the mission dealing with fly-by of a comet nucleus, it would permit ascertaining the size, shape, axis of rotation and period, morphology (existence of a silicated crust, of active or iced regions, possible craterization, mineralogical composition of the surface) and the environment (chemical composition of the dust, chemical composition of the nucleus), etc....

According to French scientists, two cameras (one wide angle, the other high resolution), two spectrometers (one infrared, the other ultraviolet), an altimetric radar system and a radiometer, a magnetometer and a dust detector/analyser, or a total mass of 100 kilograms, ought to constitute the scientific payload of this fly-by of small bodies.

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TECHNOLOGY TRANSFER

PROPOSALS FOR FRENCH-JAPANESE S&T COOPERATION

Paris AFP SCIENCES in French 5 Sep 85 7-8

[Text] Tokyo. The creation of a French-Japanese biotechnology laboratory in Japan has been proposed by the French delegation to the 2-day high technology symposium which was held in Tokyo. In the opinion of Daniel Thomas, director of the "biotechnology expansion" mobilization project in the French Ministry of Research and Technology, this biotechnology laboratory, with close ties to electronics, would serve as a training ground through research for some twenty French and Japanese researchers and engineers.

Its structure would therefore be "relatively light," and it would be organized to include several French and Japanese firms, with the support of the relevant administrations.

This French proposition, greeted "with interest" by the Japanese, will need to be refined; this is to be done during the next few months. The ideal location for this laboratory would be at the Tsukuba science center, near Tokyo, not far from the site of the world's fair of science and technology of the same name which will close soon.

France, which has made the biotechnologies sector one of its priority research sectors, has several assets in this sphere (molecular biology, enzyme use, etc...), but also some areas which are lagging significantly. The establishment of a "bridgehead" in the country currently leading in biotechnology would thus constitute a worthwhile operation, and for the Japanese as well, who have some very large gaps, in plant genetics, for example.

Furthermore, in France as in Japan, particular emphasis is going to be placed on a new aspect of biotechnology, "protein design," or, in other words, the creation of new proteins, using CAD (computer assisted design)....

Two other cooperative projects were outlined at the colloquium and will probably be followed through on. The first is in the area of new materials, one of the three themes of the symposium, along with biotechnology and robotics, and involves the likely establishment of a data bank on metallic materials (new alloys, etc...).

The goal of the specialists working in this area is to be able to manufacture made-to-order materials.... The other project--which still needs to be more precisely defined--involves robotics, more specifically the design and production of a "servant robot," for example, a robot for the handicapped.... Japan is the world leader in the number of installed robots and manipulation devices, but in France the most advanced research is concentrated on software--sight and touch systems for robots.

Finally, Michel Lavalou, vice president of the scientific and technical group in the Ministry of Research and Technology, pointed out the interest shown by the Japanese in the problems of the research and technology regionalization implemented in France--in particular what are referred to in France as the "Firtech poles" (training of engineers through research and technology), introduced jointly by the Ministry of National Education and the Ministry of Research and Technology, and which could lead to exchanges of researchers and engineers between the two countries.

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TECHNOLOGY TRANSFER

FRENCH CNET ENDEAVORS TO TRANSFER TECHNOLOGY TO INDUSTRY

Paris ELECTRONIQUE ACTUALITES in French 4 Oct 85 pp 1,6

[Article by Ph. Marel: "The 'Burning Necessity' for CNET-Industry Transfer: The MAIA Project in the Footsteps of the SM 90"]

[Text] After transferring SM 90 [Modular Structure 90] licenses to seven manufacturers, the CNET [National Center for Telecommunications Studies], which calls itself a "professional of implementation and transfer to the industry," is now negotiating the sale of manufacturing licenses for the MAIA [expansion unknown] artificial-intelligence machines with Copernique and Amaia, two private companies.

Other operations of the same type should follow.

Summing up the CNET's research on data processing on 1 October, Mr Poitevin, CNET director, stressed the "burning necessity" for transfers between his research center, which is supervised by the PTT [Post and Telecommunications Administration] and French manufacturers.

The operation started in 1983 with the SM 90 (a multiprocessor microcomputer)--for which a license was sold to seven manufacturers, including CSEE [Signals and Electric Projects Company] and Bull--will be revived in the same form for the MAIA artificial-intelligence machine developed jointly with the Marcoussis laboratory, which belongs to CGE [General Electricity Company].

Just as in the case of the SM 90, it will not be a "no-fee" transfer and the partners will be selected on the basis of "how serious their industrial plans are," Mr Poitevin indicated.

Currently, negotiations are in progress with Copernique and Amaia (a company recently created by former CNET employees).

They bear on the amount to be paid for the transfer license (it was FF 1 million for the SM 90) and on the creation of a development structure (somewhat like the GIPSI [expansion unknown]) involving public laboratories and manufacturers, and possibly the CNET as well.

At present, there are two laboratory models of the MAIA machine, but Mr Poitevin indicated that the first five or six models would be made available to

the INRIA [National Institute of Data-Processing and Automation Research] and the ARA [Advanced Automation and Robotics] group to initiate developments.

The present version of the machine is built around an AMD [Advanced Micro Devices] bit-slice microprocessor with 3 central processing units dedicated to symbolic processing, 256 kilowords (40-bit words) of core memory, and a 470 megabyte disk.

Future MAIA versions will include memories of 1 megaword (40-bit words) and later 4 megawords, with virtual addressing still set at 20 gigabytes.

In addition, a bit-mapped screen with a resolution of 1,024 x 1,024 pixels is currently the subject of specific development at the CNET.

MAIA can support both Lisp and Prolog languages for artificial intelligence and scientific languages such as Fortran and Pascal.

CNET Officials do not hesitate to claim that this machine is more powerful than any of its competitors now available on the market, essentially Symbolics machines.

Data Processing? The Opposite of a Vocation

Despite these results, it is a well-known fact that data processing is not the essential activity of the CNET; of its total personnel of over 4,000, only 300 are assigned to data-processing developments, a proportion that is also reflected in the overall budget of close to FF 1.2 billion in 1984.

Although not topmost among the CNET's concerns, the means devoted to data processing are significant because the convergence of data processing and telecommunications makes it necessary to work in both domains and also, as Mr Poitevin indicated, because the CNET is determined to pursue its developments a little further, if necessary, when it appears that some outside industrial benefits could be derived from them. We should also mention here the PTT's contribution to Bull, under the electronics sector plan.

The transfer operations involving the SM 90 and MAIA are not the only examples of this approach. The SARDE project [Technical-Documentation Electronic Filing and Retrieval System] for instance, initially designed to develop a comprehensive and up-to-date technical documentation system in the context of telecom network operations, could see its applications expanded to the automobile industry, airlines, EDF [French Electricity Company], in short to any technical multi-facility structure confronted with the same problem.

The Cubi 7 project, designed to create and display synthetic images and whose goal it is to reduce 5 to 10-fold the production costs of these images (which today are still an obstacle to their use), in particular through the use of low-cost equipment, is intended to meet first of all the needs of all audio-visual professions, but it could also be used in architecture, mechanics or medicine.

Hardware knowhow (SM 90) has already been transferred to Telmat and software knowhow to SESA [Automation Systems Study Company] and Cap Sogeti. The true data-processing "tidal wave" which is now characteristic of CNET research will lead to similar operations in the future. The center still has in its files at least 10 or so additional projects that could be the subject of such transfers.

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